

APPENDIX L

Riparian Corridor Sediment Load Allocation

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DRAFT Technical Memorandum

Lower Boise River

Prepared for
State of Idaho

by
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Lower Boise River Riparian Corridor Sediment Load Allocation

Total Acres in riparian corridor: 100,973

Rangeland, irrigated cropland (surface and sprinkler), and pasture account for 68% of the land use in the Lower Boise River riparian corridor (Table 1). Of the remaining 32%, 26% have natural or anthropogenic measures in place to significantly reduce or prevent the direct transport of sediment to the river. Furthermore, much of the sediment derived from these riparian land uses is delivered to the tributary or drain in which the land use lies and is ultimately accounted for in the load allocation for the respective tributary or drain. Table 2 lists the land uses that encompass this 26%.

The delivery coefficients shown in Table 1 for rangeland, irrigated cropland and pasture were derived using data from the NRCS Environmental Policy Integrated Climate (EPIC) model for an average year. (Appendix A).

Table 1. Major land uses in riparian corridor (68%)

Land Use	# of Acres	Delivery Coefficient (tons/acre/year)
Rangeland	34729	9.0×10^{-5}
Irrigated Cropland (sprinkler)	1836	.01
Irrigated Cropland (surface)	16520	.16
Pasture	15680	1.5×10^{-3}
	Total: 68765 acres 68% of land use in riparian corridor	

Table 2. Other land uses in the riparian corridor (26%)

Land Use	# of Acres	Delivery Coefficient (tons/acre/year)
Riparian Wetland	7320	na
Residential, farmstead	298	na
Residential, high density	3844	na
Residential, subdivision	5852	na
Residential, rural	2243	na
Commercial, industrial	3460	na
Public	912	na
Recreation	1647	na
Transport	371	na
Sewage Treatment	134	na
Tank Farm	20	na
	Total: 26101 acres 26% of land use in riparian corridor	

The land uses in Table 3 account for the remaining 6% of the land use in the riparian corridor. While this area may be delivering a minute amount of sediment to the river, it accounts for only 0.7% of the total land use in the Lower Boise River watershed. The DEQ does not feel that allocating a load to this 6% is feasible or necessary.

Table 3. Remaining land uses in the riparian corridor (6%)

Land Use	# of acres	Delivery Coefficient (tons/acre/year)
Water	1933	na
Barren	857	na
Canals	212	na
Nurseries/Orchards/Vineyards	101	na
Idle	999	na
Land in Transition	741	na
Feedlots/Stockyards	336	na
Abandon Agriculture	496	na
Other Agriculture	420	na
Unknown	12	na
	Total: 6107 acres 6% of land use in riparian corridor	

Based on these data, a typical sediment load for the Lower Boise River riparian corridor is 7.36 tons/day (Table 4). The 37% percent reduction called for in the TMDL is not applied to this load due to a variety of factors. The shallow groundwater in the riparian corridor is not conducive to growing low residue row crops such as beets and onions. For this reason, nearly all of the cropland in the corridor is occupied by high residue crops such as wheat and hay. The soils on which these types of crops grow exhibit very little sediment loss. More importantly, the USDA-NRCS's current maximum soil loss target for maintaining a productive field is 5 tons/acre/year. Based on the fact that high residue crops dominate the cropland in the corridor, and most of the fields are well below USDA-NRCS's soil loss target, implementing a 37% reduction for the cropland would be very difficult. Furthermore, the SCC has indicated that the riparian corridor is a low priority area for BMP implementation based on it's effective agricultural practices and the flat topography.

The Lower Boise River WAG is supportive of this decision.

Table 4. Sediment Load Allocation for the Boise River Riparian Corridor

Land Use	# of acres	Delivery Coefficient tons/acres/year	Load Allocation
Rangeland	34729	9.0×10^{-5}	3 tons/year
Irrigated Cropland (sprinkler)	1836	.01	18 tons/year
Irrigated Cropland (surface)	16520	.16	2643 tons/year
Pasture	15680	1.5×10^{-3}	24 tons/year
			2688/365 = 7.36 tons/day

Determining the number and location of sediment delivery points to the river via the riparian corridor is virtually impossible. Recognizing this fact, the load of 7.36 tons/day is divided into three portions and equally allocated at three locations along the corridor. Locations near Glenwood bridge, Middleton, and Parma have been chosen as sediment delivery points. These locations were chosen because they are equidistantly spaced along the river and they represent check points in the TMDL proper. The total suspended sediment mass balance spreadsheet (Figure 1) shows the specific river miles at which the sediment load is allocated. The flow component for the riparian corridor, which is used in the mass balance spreadsheet (Figure 1), is explained below.

Explanation of the flow component derivation, based on July 6, 1994 flow data.

► Flow Component:

Acres in the Lower Boise River watershed = 839,479

June 6, 1994 flow at Parma = 667 cfs

$$667 \text{ cfs} \div 839,479 \text{ acres} = 7.9 \times 10^{-4} \text{ cfs/acre}^*$$

► 839,479 acres in basin

Rangeland:	34,729 acres
Irrigated Cropland (sprinkler):	1836 acres
Irrigated Cropland (surface):	16,520 acres
Pasture:	15,680 acres

	68,765 total acres

► $68,765 \text{ acres} \times 7.9 \times 10^{-4} \text{ cfs/acre} = 54.6 \text{ cfs}$ for the riparian corridor

*Assumptions:

- 1) Equal flow from every acre in the watershed. While this is likely not the case, a lack of data prevents us from making an exact estimation.
- 2) Consistent flow from Lucky Peak Reservoir.

Summary

The mass balance spreadsheet (Figure 1) shows that after allocating an additional 7.36 tons/day to the riparian corridor, the balanced load at Parma increases three tons/day to 53 tons/day. The maximum mixed concentration in the river increases to 30 mg/l at river miles 6.5 to 9.4, but does not change at Parma. This increase in load reduces the margin of safety at at Middleton from 87% to 85% and at Parma from to 41%, from 45%. The overall margin of safety, given the critical flow, remains high.

Appendix A. Riparian Corridor Delivery Coefficients.

The values generated using the NRCS Environmental Policy Integrated Climate (EPIC) are Soil Erosion Rates. These rates describe the susceptibility of a soil particle to detach and move to the perimeter of a field, but do not describe the actual delivery of soil to the river from the field. To characterize the movement of sediment using these rates they must be converted into delivery coefficients. Unfortunately, no data exist, nor has an explicit modeling technique been identified that allows for the conversion of these rates into sediment delivery coefficients. In this instance, a ratio of erodibility to transportability has been estimated to account for the lack of data. It has been estimated that 3% of the sediment eroded from each acre of soil per year in the riparian corridor is transported to the river via the riparian corridor. While there is no definitive method of validating this estimate, it is a reasonable assumption based on a variety of factors.

- Low residue row crops such as onions and beets do not grow well in the riparian corridor due to the shallow water table. Therefore, high residue crops such as wheat and hay dominate the cropland portion of the corridor. The soils on which these types of crops grow exhibit very little sediment loss, primarily due to extensive root systems and the sheer surface density of the crop itself.
- There is very little gradient in the majority of the riparian corridor. In areas such as these, rill and gully development are the primary mechanisms by which sediment is transported. However, it takes a large amount of precipitation over a short period of time to produce rill or gully erosion on low gradient, covered and stable soils. The climatic pattern in the Lower Boise River watershed is such that events of this nature are rare.
- The soil erosion rates were modeled using the highest (worst case scenario) erodibility factor (K) appropriate for the riparian soils, as derived from USDA soil surveys. The K factor, when integrated into the EPIC model, describes the erodibility of the soil based on the structural geology of the top few inches of soil stratum. In this instance, the erosion rates were modeled using a K factor of 0.49. The K factor typically ranges from 0.10 for highly stable soils to 0.60 for highly erodible soils. While unstable soils do exist in the riparian corridor, they do not typify the majority of the corridor. Therefore, the erosion rate that has been modeled is presumably higher than actual conditions.
- The EPIC model generates a value that characterizes the amount of sediment displaced from its original position. It does not characterize sediment movement and hence does not account for the likelihood of re-deposition during movement, which is a critical element of sediment transport.
- The Boise Public Works storm water plan, which encompasses all riparian development (roads, subdivisions, etc.) in the City of Boise, outlines management plans that use BMPs to control riparian drainage and its associated sediment load within urban/suburban developed areas. The majority of the urban/suburban riparian development that has or is occurring is within Boise city limits.

- Based on the estimation that 3% of the sediment eroded from each acre of soil per year in the riparian corridor is transported to the river, the load for the riparian corridor is 7.36 tons/day. The total sediment load for the watershed (point and non-point sources) including the riparian load is 172.92 tons/day (without 37% reduction, based on June 6, 1994 mass balance). These figures indicate the riparian corridor, which accounts for 11% of the land in the watershed, is contributing 4.2% of the total sediment load, which is a reasonable estimation.

Table 1. Erosion rates and estimated delivery coefficients for surface and sprinkler irrigated cropland, pasture and rangeland (erosion rates modeled using NRCS EPIC)

	Surface	Sprinkler	Pasture	Rangeland
Erosion Rate tons/acre/year (96 yr ave)	5.2	.38	.05	.003
Delivery Coefficient tons/acre/year at 3% of erosion rate	.16	.01	1.5×10^{-3}	9.0×10^{-5}